

A Quantitative Assessment of Agricultural Intensification and Associated Waste-management Challenges in the Lower Fraser Valley

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Abstract

Changes in agricultural intensification in the Lower Fraser Valley were evaluated using agricultural census data for 1991, 1996 and 2001. Recent trends in animal numbers, and land use changes were determined and a nutrient balance model was used to determine areas of surplus nutrient application for both nitrogen and phosphorus. The results showed that the livestock industry remains very dynamic. Between 1996 and 2001 the overall number of hogs produced has declined by 5 %, cattle production remains relatively stable, but chicken production increased by a massive 36%. The continuous concentration of animals in key agricultural areas is of particular concern. Based on the nutrient budget analysis it is evident that most of the areas that had large nutrient surplus applications in 1996, continued to have waste nutrient management problems. Not only have the application rates increased but the atmospheric return of nitrogen is much higher than the rates used in 1996. The interactive nutrient model was redesigned and linked to GIS to enable users to see where the nutrient surplus areas are, how the applications have changed over the past 10 years, and how the problem can be mitigated by running different scenarios. This dynamic model allows decision-makers to compare different scenarios and select various options for improving agricultural waste management under different agricultural growth projections.

Extended Abstract

Intensification of livestock production in the rural-urban fringe area of Vancouver is becoming of increasing concern, because agriculture is now considered the largest contributor to nonpoint source pollution. A spreadsheet based nutrient budget model was developed to examine the nutrient dynamics in the Lower Fraser Valley and to identify areas where excessive nutrient surplus applications have occurred over the past 10 years. The Agricultural Census data, which is collected every 5 years, was used as a data source for animal numbers, areas under different crop production, and land use activities. Additional information for atmospheric deposition, fertilizer use and management practices were obtained from local sources and field surveys. The Lower Fraser Valley was divided into 20 agricultural areas and the nitrogen and phosphorus surplus was determined for 1991, 1996, and 2001.

The results showed that in 2001, 65% of the areas in the Lower Fraser Valley had surplus nitrogen applications in excess of 100 kg/ha/year and phosphorus surplus applications were in excess of 50 kg/ha/year. These values are above what is needed by the plants and are a threat to the freshwater resources in each surplus area resulting in eutrophication and water quality deterioration. Awareness of this problem was created in 1995 when the results of the model classification were first released based on the 1991 Census data (Brisbin 1995). The model was updated and refined in 1998 and again in 2002 to reflect the changes that have taken place in the feed composition and soil and site management. Some efforts were made since 1995 to reduce excess nutrient inputs and to move manure from surplus areas to deficit areas. In spite of these efforts the surplus nitrogen applications have increased in 45% of the areas between 1996 and 2001 and the surplus phosphorus applications have increased in 75% of the areas. The reasons for these increases are twofold:

1. The management measures taken to reduce inputs and to move manure to deficit areas are insufficient, and
2. The animal numbers continue to increase.

Overall the cattle, pig and sheep numbers have declined in the LFRV but the number of dairy cows and chickens continue to increase. Chicken production increases have been particularly dramatic with a 28% increase between 1991-1996 and a 52% increase between 1996 and 2001. What is also of concern is that the increases continue to occur in those areas where significant groundwater resources exist and where the surpluses were already the highest in 1996. The other trend that is responsible for these surplus problems is the fact that individual farms continue to increase their stocking density. The LFRV has now the largest number of dairy cows per farm in Canada and there has been a 78% increase in number of chickens/farm over the past 10 years, a 75% increase in goat numbers/farm, a 70% increase in Dairy cows and a 50% increase in pig numbers/farm. These numbers clearly indicate that agricultural intensification is on a rapid rise.

The effects of surplus nitrogen applications on water quality was demonstrated by Berka et al (2000) and the time has come where more dramatic changes to management needs to be made in order to reduce the risk of surface and groundwater pollution. Measures taken to reducing N and P input in feed, and moving manure from surplus to deficit areas alone are insufficient measure. A combination of best management practices are needed to be enforced.

Consideration should also be given to the creation of minimum size vegetated buffer zone around stream as a way to help in the absorption of excess nutrients. If these animal production trends continue to increase we need to give serious consideration to initiating manure waste treatment facilities, particularly in those areas in the Lower Fraser Valley where the industrialization of livestock operation are the highest.

References

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